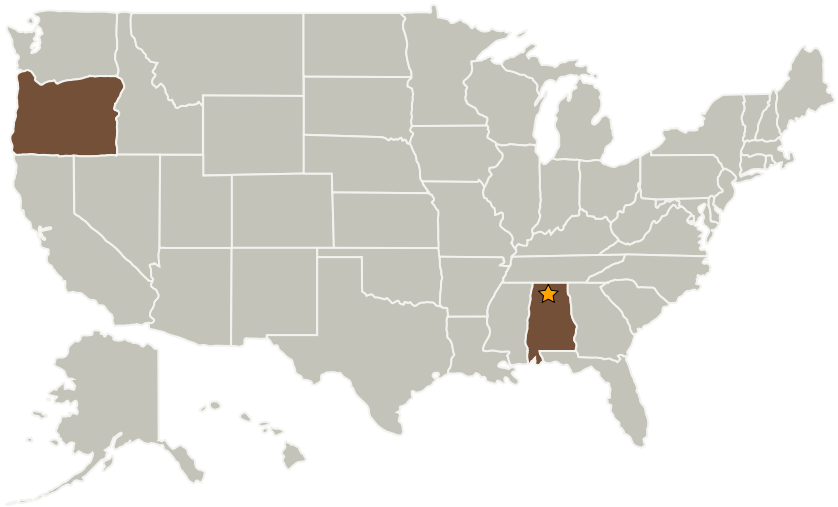
Hydrogen Recovery by ECR Plasma Pyrolysis of Methane, Phase II

Completed Technology Project (2006 - 2008)

Project Introduction

Development of a microgravity and hypogravity compatible microwave plasma methane pyrolysis reactor is proposed to recover hydrogen which is lost as methane in the conversion of carbon dioxide to water via the Sabatier process. This will close the hydrogen loop which currently requires 50% resupply. Efficient production of hydrogen from methane was conclusively demonstrated during Phase I using microwave plasmas with power levels ranging between 50 - 120 W. In the plasma reactor, formation and deposition of solid phase elemental carbon was shown to be far less problematic than for current methods of catalytic methane decomposition in fixed bed and fluidized bed reactors. This new technology has strong potential for continuous hydrogen production over extended time periods, with minimal maintenance and operator intervention. Microwave plasmas produce extremely high temperatures localized within very small volumes, resulting in low overall power requirements. Microwave plasmas also produce minimal thermal effects on downstream piping and other system components. These features provide the basis for a small, light, and low power method for hydrogen reclamation. By recovering all of the hydrogen which is lost as methane in the Sabatier reactor, the requirement for production or resupply of hydrogen is reduced to the absolute minimum.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
UMPQUA Research Company	Supporting Organization	Industry	Myrtle Creek, Oregon

Primary U.S. Work Locations	
Alabama	Oregon

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.3 Resource Processing for Production of Mission Consumables